



High-Speed, CMOS, Quad, SPST Analog Switch

HI-201HS

General Description

Maxim's HI-201HS is a monolithic, CMOS, quad, single-pole-single-throw (SPST), high-speed analog switch featuring fast switching times ($t_{OFF} \leq 50\text{ns}$) and low on resistance (50Ω max). It is pin compatible with the industry-standard DG201A.

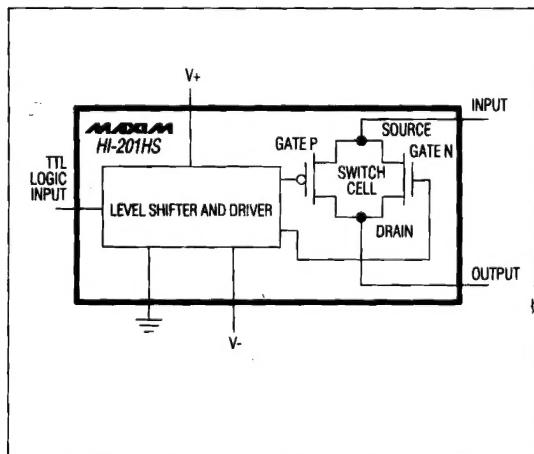
Maxim's new high-voltage silicon-gate technology increases the maximum supply-voltage rating to 44V. This improvement allows continuous operation with $\pm 20\text{V}$ supplies, which is not permitted with the original manufacturer's devices. Maxim's HI-201HS operates from dual supplies ranging from $\pm 5\text{V}$ to $\pm 20\text{V}$, or from single supplies from +12V to +20V. Logic levels are TTL-/CMOS-compatible with single or dual supplies within these ranges.

Maxim's HI-201HS is guaranteed not to latch up if power supplies are disconnected while the analog-switch inputs are present, provided the switch continuous-current ratings are not exceeded. When powered up, the HI-201HS will switch analog signals up to the power-supply rails.

Applications

- Automatic Test Equipment (ATE)
- Heads-Up Displays
- Communication Systems
- Sample-and-Hold Circuits
- Military
- Integrator Reset Circuits

Functional Diagram



Features

- ◆ Guaranteed Single-Supply Operation: +12V to +20V
- ◆ Guaranteed Dual Supplies: $\pm 5\text{V}$ to $\pm 20\text{V}$
- ◆ Fast Switching Times:
 $t_{ON} = 30\text{ns}$
 $t_{OFF} = 40\text{ns}$
- ◆ Low, 50Ω Max On Resistance
- ◆ TTL-/CMOS-Compatible
- ◆ 44V Max Supply Rating

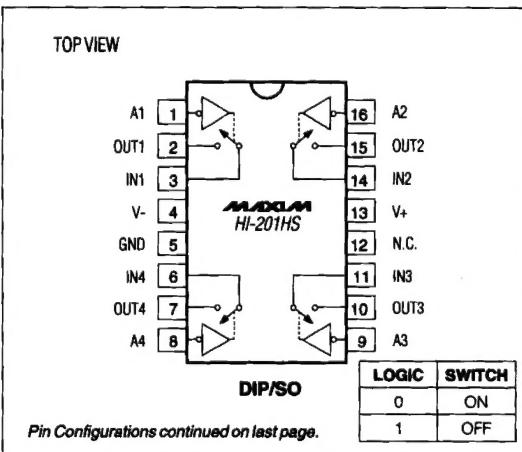
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
HI3-0201HS-5	0°C to +70°C	16 Plastic DIP
HI6-0201HS-5	0°C to +70°C	16 Narrow SO
HI1-0201HS-5	0°C to +70°C	16 CERDIP
HI0-0201HS-6	0°C to +70°C	Dice*
HI3-0201HS-9	-40°C to +85°C	16 Plastic DIP
HI6-0201HS-9	-40°C to +85°C	16 Narrow SO
HI1-0201HS-9	-40°C to +85°C	16 CERDIP
HI1-0201HS-2	-55°C to +125°C	16 CERDIP
HI4-0201HS-8	-55°C to +125°C	20 LCC**

* Contact factory for dice specifications.

** Contact factory for availability.

Pin Configurations



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ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-						
V ₊	44V					
GND	25V					
Digital Inputs V _S , V _D (Note 1)	(V ₋ - 4V) to (V ₊ + 4V) or 30mA (whichever occurs first)					
Current (any terminal, except S or D)	30mA					
Continuous Current, S or D	20mA					
Peak Current, S or D (pulsed at 1ms, 10% duty cycle max)	40mA					
Continuous Power Dissipation (T _A = +70°C, Note 2)						
16-Pin DIP (derate 10.53mW/°C above +70°C)	842mW					
16-Pin Wide SO (derate 9.52mW/°C above +70°C)	762mW					
16-Pin CERDIP (derate 10.00mW/°C above +70°C)	800mW					
20-Pin LCC (derate 9.09mW/°C above +70°C)	727mW					
Operating Temperature Ranges:						
HI-0201HS-5/-6	0°C to +70°C					
HI-0201HS-9	-40°C to +85°C					
HI-0201HS-2/-8	-55°C to +125°C					
Storage Temperature Range	-65°C to +150°C					
Lead Temperature (soldering, 10sec)	+300°C					

Note 1: Signals on S_x, D_x, or I_{Nx} exceeding V₊ or V₋ are clamped by internal diodes. Limit forward current to maximum current ratings.

Note 2: All leads soldered or welded to PC board.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V₊ = 15V, V₋ = -15V, GND = 0V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/-8			HI-201HS-5/-6/-9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
SWITCH									
Analog-Signal Range	V _{ANALOG}		-15	15	-15	15	15	15	V
Drain-Source On Resistance (Note 5)	r _{DS} (on)	V _D = ±10V, V _{IN} = 0.8V, I _S = 1mA	30	50	30	50	30	50	Ω
Source-Off Leakage Current	I _S (off)	V _{IN} = 3.0V	V _S = 14V, V _D = -14V	-1	±0.01	1	-1	±0.01	1
			V _S = -14V, V _D = 14V	-1	±0.02	1	-1	±0.02	1
Drain-Off Leakage Current	I _D (off)	V _{IN} = 3.0V	V _D = 14V, V _S = -14V	-1	±0.01	1	-1	±0.01	1
			V _D = -14V, V _S = 14V	-1	±0.02	1	-1	±0.02	1
Drain-On Leakage Current (Note 6)	I _D (on)	V _D = -14V, V _{IN} = 0.8V	-1	±0.10	1	-1	±0.10	1	nA
		V _D = 14V, V _{IN} = 0.8V	-1	±0.15	1	-1	±0.15	1	nA
LOGIC INPUT									
Input Current with Input Voltage High	I _{INH}	V _{IN} = 3.0V	-1	0	1	-1	0	1	μA
		V _{IN} = 15V	-1	0	1	-1	0	1	
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V	-1	0	1	-1	0	1	μA

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ELECTRICAL CHARACTERISTICS (continued)

(V₊ = 15V, V₋ = -15V, GND = 0V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/-8			HI-201HS-5/-6/-9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
DYNAMIC									
Turn-On Time	t _{on}	Figure 6	30	50		30	50		ns
Turn-Off Time	t _{off}	Figure 6	40	50		40	50		ns
	t _{off2}		150			150			
Output Settling Time			180			180			ns
Charge Injection	Q	C _L = 1000pF, V _{GEN} = 0V, R _{GEN} = 0Ω	10			10			pC
Source-Off Capacitance	C _S (off)	V _S = 0V, V _{IN} = 5V		f = 140kHz	10		10		pF
Drain-Off Capacitance	C _D (off)	V _S = 0V, V _{IN} = 5V		f = 140kHz	10		10		pF
Channel-On Capacitance	C _D (on) ⁺ C _S (on)	V _D = V _S = 0V, V _{IN} = 0V		f = 140kHz	30		30		pF
Off Isolation		V _{IN} = 3VRMS, Z _L = 1kΩ, f = 100kHz			72		72		dB
Crosstalk (Channel-to-Channel)		V _S = 2.0V, f = 100kHz			90		90		dB
SUPPLY									
Positive Supply Current	I ₊	All channels on or off	-3.0	3.8	6.5	-3.0	3.8	6.5	mA
Negative Supply Current	I ₋				1.0		1.0		mA
Power-Supply Range for Continuous Operation	V _{OP}	(Note 5)	±4.5		±20	±4.5		±20	V

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ELECTRICAL CHARACTERISTICS

(V₊ = 15V, V₋ = -15V, GND = 0V, TA = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/-8			HI-201HS-5/-6/-9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
SWITCH									
Analog-Signal Range	V _{ANALOG}		-15	15	-15	15	15	V	
Drain-Source On Resistance (Note 5)	r _D (on)	V _D = ±10V, V _{IN} = 0.8V, I _S = 1mA		75			75	Ω	
Source-Off Leakage Current	I _S (off)	V _{IN} = 3.0V	V _S = 14V, V _D = -14V	-100	100	-50	50	nA	
			V _S = -14V, V _D = 14V	-100	100	-50	50	nA	
Drain-Off Leakage Current	I _D (off)	V _{IN} = 3.0V	V _D = 14V, V _S = -14V	-100	100	-50	50	nA	
			V _D = -14V, V _S = 14V	-100	100	-50	50	nA	
Drain-On Leakage Current (Note 6)	I _D (on)	V _D = -14V, V _{IN} = 0.8V	-100	100	-50	50	50	nA	
		V _D = 14V, V _{IN} = 0.8V	-100	100	-50	50	50	nA	
LOGIC INPUT									
Input Current with Input Voltage High	I _{INH}	V _{IN} = 3.0V	-1.0	1.0	-1.0	1.0			μA
		V _{IN} = 15V	-1.0	1.0	-1.0	1.0			
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V	-1.0	1.0	-1.0	1.0			μA
DYNAMIC									
Turn-On Time	t _{on}	See Figure 6			75		75	ns	
Turn-Off Time	t _{off}	See Figure 6			75		75	ns	
SUPPLY									
Positive Supply Current	I ₊	All channels on or off			10		10	mA	
Negative Supply Current	I ₋	All channels on or off	6		6		6	mA	

Note 3: The algebraic convention where the most negative value is a minimum and the most positive a maximum is used in this data sheet.

Note 4: Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.

Note 5: Electrical characteristics, such as on resistance, will change when power supplies other than ±15V are used.

Note 6: I_{D(on)} is leakage from driver into on switch.

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Protecting Against Fault Conditions

Fault conditions occur when power supplies are turned off and input signals are still present, or when overvoltages occur at the inputs during normal operation. In either case, source-to-body diodes can be forward biased and conduct current from the signal source. If this current must be kept at low (μ A) levels, we recommend adding external protection diodes (Figure 1).

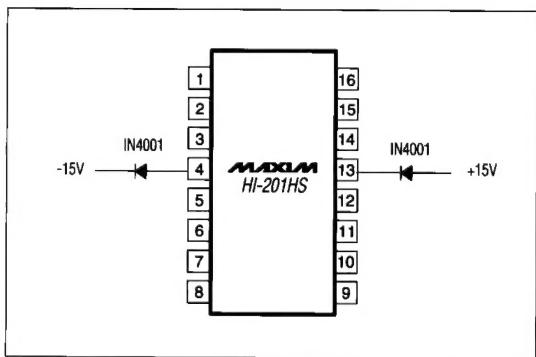


Figure 1. Protection Against Fault Conditions

To provide protection for overvoltages up to 20V above the supplies, place a 1N4001 or 1N914 type diode in series with the positive and negative supplies, as shown in Figure 1. Adding these diodes will reduce the analog-signal range to 1V below the positive supply and 1V above the negative supply.

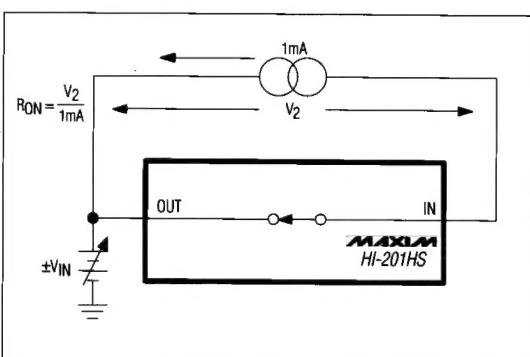


Figure 2. On Resistance

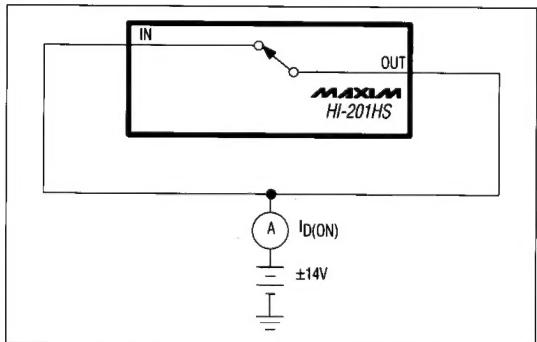


Figure 3. On Leakage Current

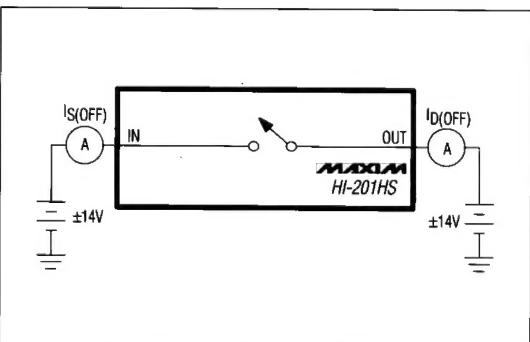


Figure 4. Off Leakage Current

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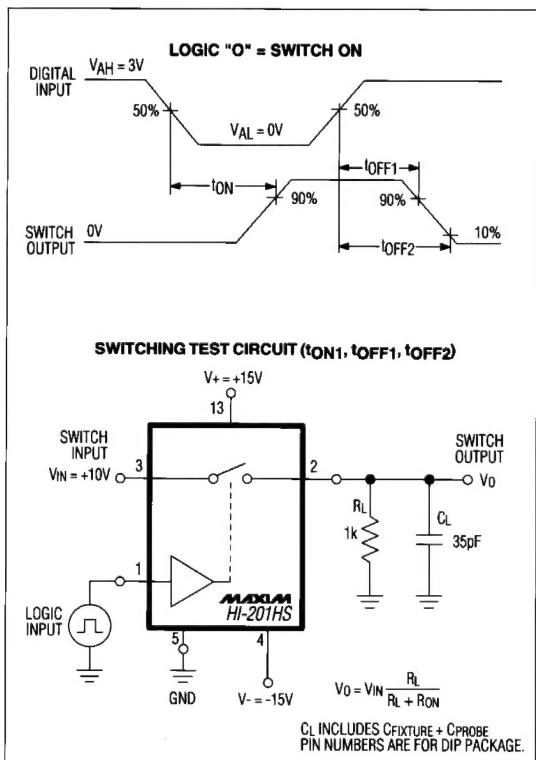
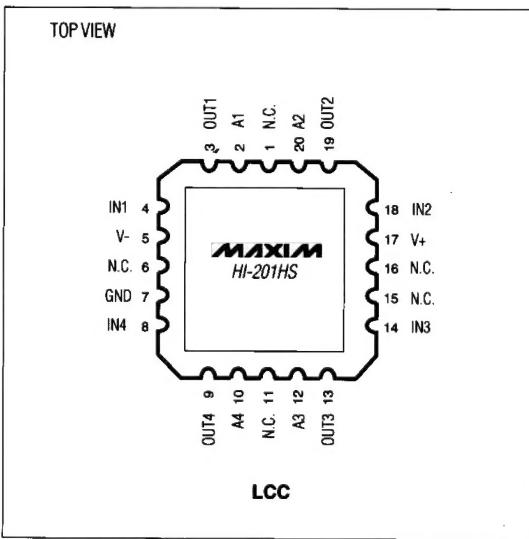


Figure 6. Switching-Time Test Circuit

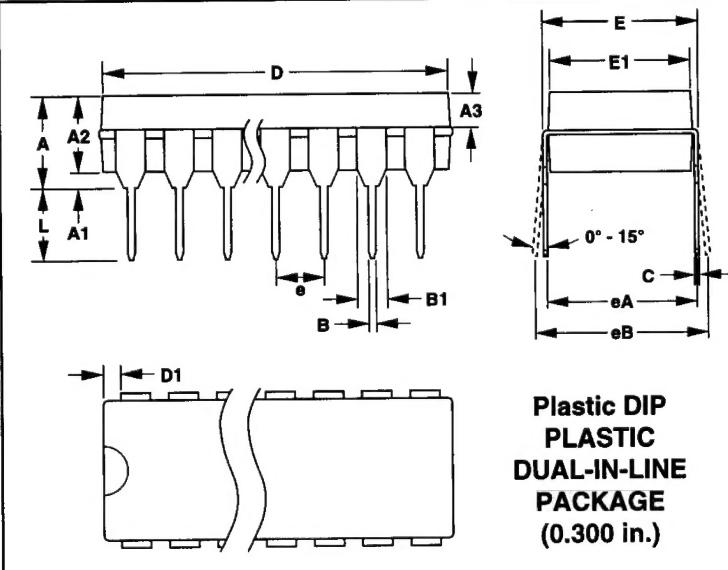
Pin Configurations (continued)



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Package Information

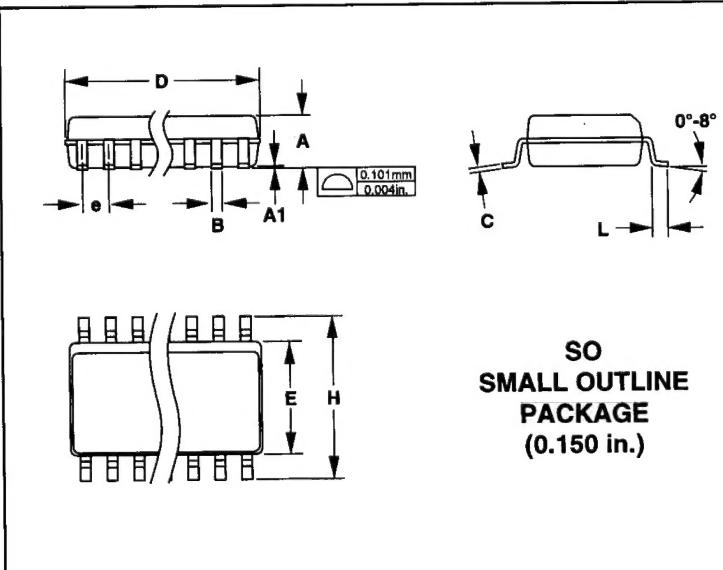
HI-201HS



**Plastic DIP
PLASTIC
DUAL-IN-LINE
PACKAGE
(0.300 in.)**

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
A1	0.015	—	0.38	—
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.016	0.022	0.41	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100	—	2.54	—
eA	0.300	—	7.62	—
eB	—	0.400	—	10.16
L	0.115	0.150	2.92	3.81

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	0.348	0.390	8.84	9.91
D	14	0.735	0.765	18.67	19.43
D	16	0.745	0.765	18.92	19.43
D	18	0.885	0.915	22.48	23.24
D	20	1.015	1.045	25.78	26.54
D	24	1.14	1.265	28.96	32.13



**SO
SMALL OUTLINE
PACKAGE
(0.150 in.)**

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
E	0.150	0.157	3.80	4.00
e	0.050	—	1.27	—
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

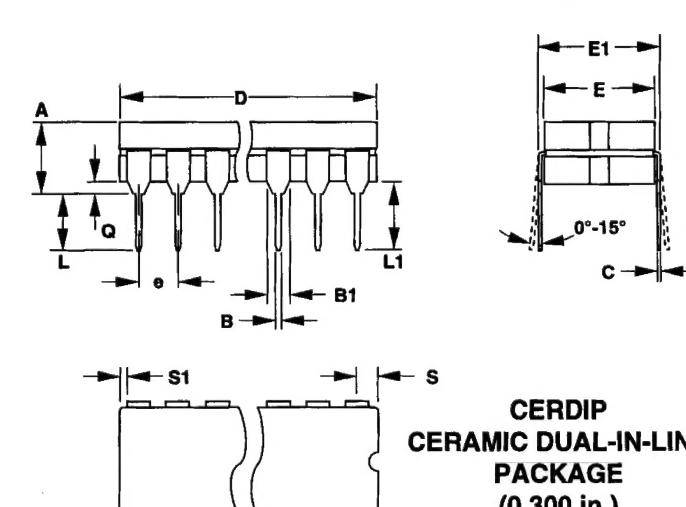
DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	0.189	0.197	4.80	5.00
D	14	0.337	0.344	8.55	8.75
D	16	0.386	0.394	9.80	10.00

21-0041A

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Package Information (continued)



The technical drawing illustrates the physical dimensions of the HI-201HS package. The top view shows the overall width (D), height (L), and lead spacing (Q). The side view shows the lead thickness (e), lead pitch (B1), and lead height (L1). An angle indicator (0°-15°) specifies the lead tip angle.

CERDIP CERAMIC DUAL-IN-LINE PACKAGE (0.300 in.)

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
B	0.014	0.023	0.36	0.58
B1	0.038	0.065	0.97	1.65
C	0.008	0.015	0.20	0.38
E	0.220	0.310	5.59	7.87
E1	0.290	0.320	7.37	8.13
e	0.100		2.54	
L	0.125	0.200	3.18	5.08
L1	0.150	—	3.81	—
Q	0.015	0.070	0.38	1.78
S	—	0.098	—	2.49
S1	0.005	—	0.13	—

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	—	0.405	—	10.29
D	14	—	0.785	—	19.94
D	16	—	0.840	—	21.34
D	18	—	0.960	—	24.38
D	20	—	1.060	—	26.92
D	24	—	1.280	—	32.51

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